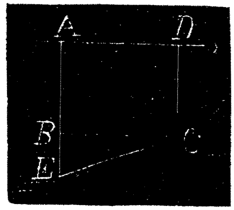
pressure upon $ABCD$ with respect to $AD=c\int_0^b x^2dx=\frac{1}{3}b^3c$, and the moment of the pressure upon $BCE=\dfrac{c}{a-b}\int_0^{a-b}(a-b-x)(x+b)^2dx=\frac{1}{12}c(a-b)(a^2+2ab+3b^2)$.

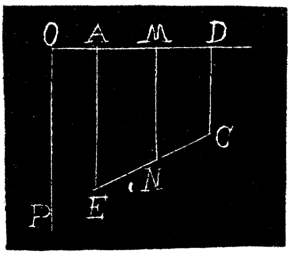
Adding, we find the moment of the pressure upon the trapezoid $AECD$ with respect to $AD=\frac{1}{12}c(a+b)(a^2+b^2)$



For $ABFE$, $a=10$, $b=4$, $c=2$; $\therefore$ Moment$=270\frac{2}{3}$.
For $FBCG$, $a=4$, $b=5$, $c=3$; $\therefore$ Moment$=92\frac{1}{4}$.
For $GCDH$, $a=5$, $b=7$, $c=1$; $\therefore$ Moment$=74$.
For $EADH$, $a=10$, $b=7$, $c=6$; $\therefore$ Moment$=1266\frac{1}{2}$.

Adding the moments of the first three and then subtracting the sum from the moment of the fourth, we get the moment of $ABCD=829\frac{7}{12}$. Therefore, distance of the center of pressure of $ABCD$ from $EH=829\frac{7}{12}\div\frac{355}{3}=7\frac{3}{284}$.

Let $AECD$ represent a trapezoid with right angles at A and D, AD the surface of the water, OP a perpendicular, and MN a perpendicular to OD ; $AE=a$, $CD=b$, $AD=c$, $OA=h$, $MN=y$, $AM=x$.



$\therefore$ Moment of pressure upon $AECD$ with respect to OP

$$=\frac{1}{2}\int_0^c y^2(x+h)dx, \text{ where } y=\frac{c}{a-b}(a-b-x).$$

Substituting, we get for the moment of $AECD$ with respect to AD the expression $\frac{1}{24}c[c(a^2+2ab+3b^2)+4h(a^2+ab+b^2)]$.
For $ABFE$, $a=10$, $b=4$, $c=2$, $h=0$; $\therefore$ Moment$=38$.
For $BCGF$, $a=4$, $b=5$, $c=3$, $h=2$; $\therefore$ Moment$=110\frac{1}{8}$.
For $CDHG$, $a=5$, $b=7$, $c=1$, $h=5$; $\therefore$ Moment$=100\frac{11}{12}$.
For $ADHE$, $a=10$, $b=7$, $c=6$, $h=0$; $\therefore$ Moment$=580\frac{1}{2}$.

Snbtracting the sum of the first three from the last, we find for the moment of $ABCD$ with respect to AE, $330\frac{11}{24}$.

$\therefore$ Distance of the center of pressure from $AE=330\frac{11}{24}\div\frac{355}{3}=2\frac{2251}{2840}$.

And thus the position of the center of pressure is fully determined.

51. Proposed by H. C. WHITAKER, A. M., Ph. D., Professor of Mathematics, Manual Training School, Philadelphia, Pennsylvania.

"Swift of foot was Hiawatha.
He could shoot an arrow from him
And run forward with such fleetness
That the arrow fell behind him!
Strong of arm was Hiawatha;
He could shoot ten arrows upward
Shoot them with such strength and swiftness
That the tenth had left the bowstring
Ere the first to earth had fallen." *Longfellow.*

Assuming Hiawatha to have been able to shoot an arrow every second and to have aimed when not shooting vertically so that the arrow might have the longest range; what was Hiawatha's time in a hundred yards ?

I. Solution by ALFRED HUME, C. E., D. Sc., Professor of Mathematics, University of Mississippi, University, Miss.

An arrow rises $4\frac{1}{2}$ seconds when shot vertically, and therefore, the initial velocity which Hiawatha is able to impart to an arrow is $\frac{9}{2}g$ feet per second.

The angle of elevation for the longest range is 45°, and therefore, the horizontal component of the velocity of the arrow is $\frac{1}{4}(9\sqrt{2})g$. This being Hiawatha's speed, his time for 100 yards is a very little less than 3 seconds.

In the above it has been assumed that Hiawatha ran the whole distance at a uniform rate. The range is much more than a hundred yards.

II. Solution by S. ELMER SLOCUM, Union College, Schenectady, N. Y.; J. P. BURDETT, Class '97, Dickinson College, Carlisle, Penn.; and E. W. MORRELL, A. M., Professor of Mathematics, Montpelier Seminary, Montpelier, Vt.

Let t=time of flight when the arrows are shot vertically upward, and u be the initial velocity. Then $t=2u/g$, and $u=\frac{1}{2}gt=144$ feet per second.

The range of a projectile is $u^2\sin2\theta/g$, and since the greatest value of $\sin2\theta$ is 1, the maximum range is u^2/g.

$\therefore$ Range$=u^2/g=648$ feet. Time of flight for projectile is $2u\sin\theta/g$ $=6.363$ seconds.

$\therefore$ Velocity$=648\div6.363=101.8+$ feet per second.

Time for 100 yards$=(300\div101.8+)=2.94$ seconds.

AVERAGE AND PROBABILITY.

Conducted by B. F. FINKEL, Springfield, Mo. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

52. Proposed by B. F. FINKEL, A. M., M. Sc., Professor of Mathematics and Physics, Drury College, Springfield, Missouri.

A straight line of length a is divided into three parts by two points taken at random; find the chance that no part is greater than b. [From *Hall and Knight's Higher Algebra.*]

I. Solution by HENRY HEATON, M. Sc., Atlantic, Iowa.

There are two cases. I, when $b>\frac{1}{3}a$ and $<\frac{1}{2}a$, and II, when $b>\frac{1}{2}a$ and $<a$.

Case I. Let AB represent the line a. Let P be the position of the first point, and let $AP=x$. Lay off PC and BD each$=b$. Then the favorable positions for the second point lie between C and D. $DC=x+2b-a$. The limits of x are $a-2b$ and b.

Hence the required chance is $P_1=\dfrac{1}{a^2}\displaystyle\int_{a-2b}^{b}(x+2b-a)dx=\dfrac{(3b-a)^2}{2a^2}$.